Introduction

In various real-world scenarios, navigating through complex environments efficiently is a challenging task. One such problem is finding the most efficient way (minimum number of moves) to reach the **goal state** (organised process) from the **initial state** (unorganised process). This problem has wide applications in various domains such as robotics, scheduling, game theory, emergencies, and resource allocation.

To tackle this challenge, artificial intelligence agents can be utilised to intelligently explore and optimise the fastest way to figure out the puzzle. Therefore, finding out the optimum order of priority while considering other constraints. One useful real-world application for this task is for the **emergency organisation of the injured on-site.**

During natural disasters, prioritising casualties quickly and efficiently amidst chaos is crucial to minimise overall harm. Mass casualties following disasters and major incidents are often characterised by a quantity, severity, and diversity of injuries that can rapidly overwhelm the ability of local medical resources to deliver comprehensive and definitive medical care [1]. To ease their burden, AI agents can help organise the patients, **after medical intervention has been done, and the injuries have been marked, arranging them in the order as soon as possible can be achieved intelligently artificially**. AI agents can optimise the organisation process, that is in the shortest time possible and avoid putting more lives in danger, by considering factors like obstacles, victim density, and severity.

Therefore, through this exercise, we aim to **design** and **formulate** an agent which will **optimise the organisation in order of priority**, so that the **most injured** receive treatment **as soon as possible** and maximum damage is avoided.

Type of Agent

The agent we are modelling is a **Non-Autonomous Utility-Based Agent**:

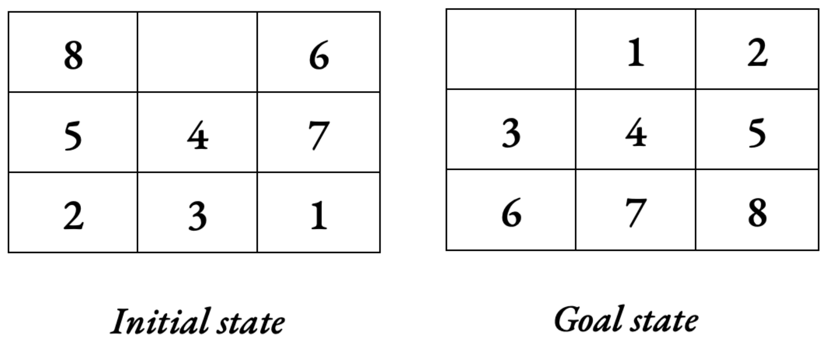
1. It is non-autonomous as all necessary information, such as the initial configuration tiles and rules, are provided to the agent. The agent's task is to respond based on this information **(grid information & initial and goal states)** and predefined search algorithms. The agent will then figure out the best action to be taken **(utility).**
2. To address the fact that multiple action sequences may lead to achieving the same goal, it is necessary to define utility functions. These functions enable the agent to evaluate and select the most optimal solution by considering various factors.

Types of Environments

Properties	**Elaborations**
Accessible	The agent has **access** to the layout of the grid, including the tiles and their assigned number, current configuration of tiles and the rules governing tile movement. Initial & goal states will also be given to aid the agent to infer and make decisions.

Deterministic	The environment's next state depends entirely on the current state and the actions chosen by the agent. The grid's state is fully determined by the agent's current movement or action, making it **deterministic**.
Sequential	The environment is sequential as each action taken by the agent influences **subsequent** actions. The agent must consider the consequences of its decisions to progress toward the solution.
Static	The 8-piece puzzle game **remains unchanged** while the agent is solving it. There are no external factors altering the puzzle during the solving process.
Discrete	The 8-piece puzzle game consists of a finite number of **discrete** states, defined by the configuration of tiles on the grid and rules of movement.

Problem Formulation

Properties	**Description**
Definition of Problem	 Image Reference [2] The 8-piece puzzle game is a sliding puzzle consisting of a 3x3 grid with eight numbered titles and one empty space. The objective is to rearrange the tiles by sliding them into the empty space until they are arranged in a particular order in the least number of moves (***in optimum time***).[3].The lines between the numbers are represented as the obstacles, and the numbers are reported as the priority of injuries with 1- being the most injured and 8- being the least injure. Therefore, we need to get the most injured to receive treatment as soon as possible while also arranging the priority for other injured patients in the shortest time possible.
Initial State	The **initial state** consists of a configuration of tiles on the grid, with one tile missing (empty space). The agent's task is to rearrange the tiles to reach the goal configuration.
Action Sets	The agent's **actions** involve sliding a single tile into the empty space, either horizontally or vertically, following the rules of the 8-piece puzzle game. It can explore different sequences of moves and backtrack if necessary.
Goal Test Predicate	The **goal** is to rearrange the tiles on the grid to match a specific goal configuration, typically arranged in numerical order from 1 to 8, with the empty space in a specific position.
Cost Function	The **cost** associated with each action is uniform, representing the effort or energy expended by the agent to slide a tile into the empty space. Each move incurs a cost of 1.
Solution	The **solution** is a sequence of moves that successfully rearranges the tiles on the grid to match the

	goal configuration, satisfying all the rules of the 8-piece puzzle game.

References

1. *Health emergency and disaster risk management. (2017). In Health Emergency and Disaster Risk Management Fact Sheets [Report].* *https://cdn.who.int/media/docs/default-source/disaster-mngmt/risk-management-injuries-december2017.pdf?sfvrsn=34d5d5ce_1#:~:text=Immediately%20after%20a%20disaster%2C%20severe,other%20facets%20of%20these%20situations*.
2. *The 8-Puzzle*. (n.d.). https://www.aiai.ed.ac.uk/~gwickler/eightpuzzle-uninf.html
3. *8 Puzzle background*. (n.d.). https://www.d.umn.edu/~jrichar4/8puz.html#:~:text=What%20is%20an%208%20Puzzle,in%20the%20%22goal%20state%22.